

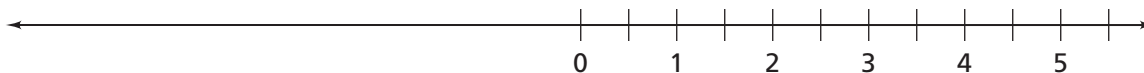
Investigation

1

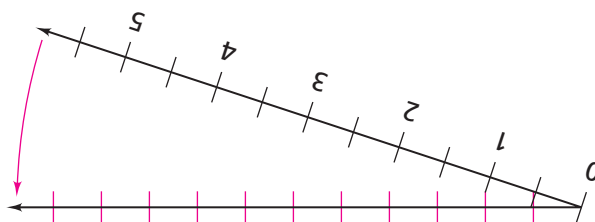
Extending the Number System

In your study of numbers, you have focused on operations ($+$, $-$, \times , and \div) with whole numbers, fractions, and decimals. In this unit, you will learn about some important new numbers in the number system.

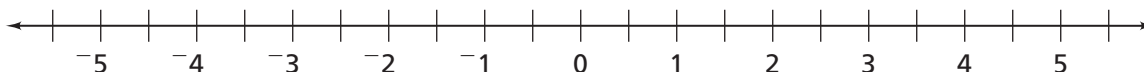
Suppose you start with a number line showing 0, 1, 2, 3, 4, and 5.



Take the number line and fold it around the zero point. Make marks on the left side of zero to match the marks on the right side.



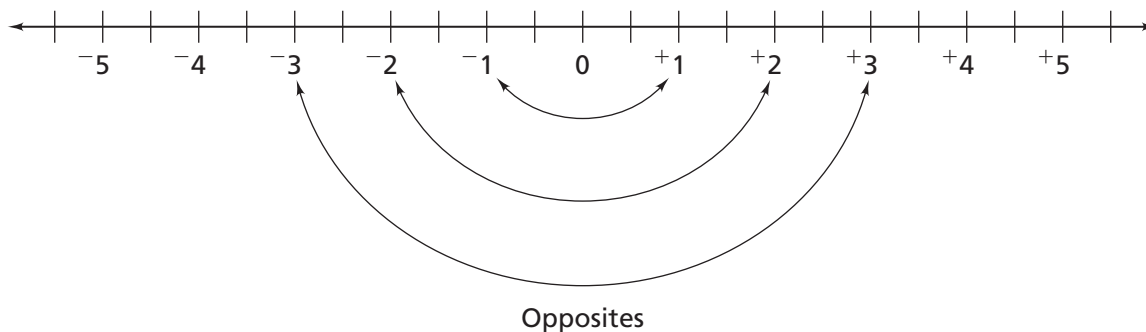
Label the new marks with numbers that have negative signs ($-$). These numbers (to the left of 0) are **negative numbers**.



I owe my Dad 3 dollars,
so I have -3 dollars.



Each negative number is paired with a **positive number**. The numbers in the pair are the same distance from zero but in opposite directions on the number line. These number pairs are called **opposites**. You can label positive numbers with positive signs (+).

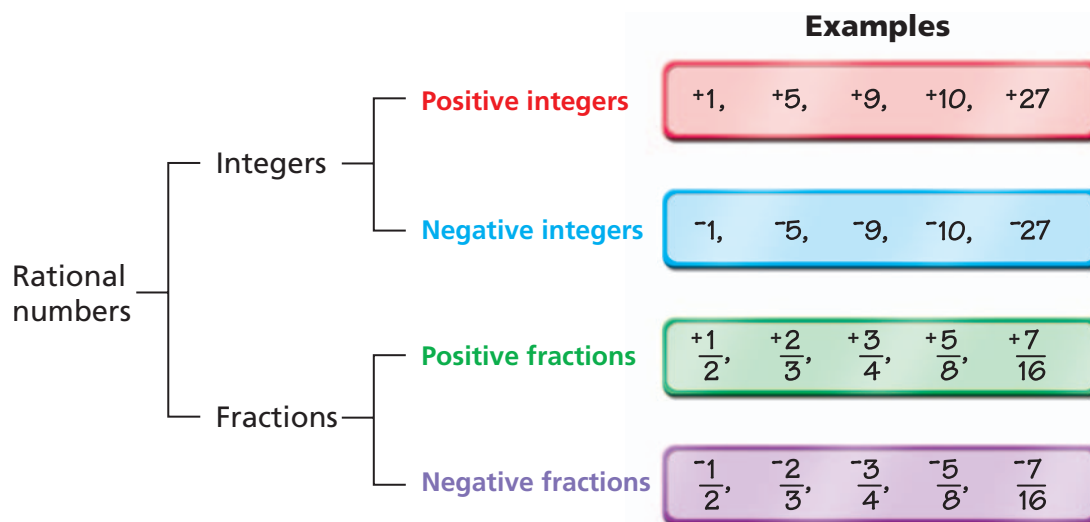


Some subsets of the positive and negative numbers have special names. Whole numbers and their opposites are called **integers** (-4 , -3 , -2 , -1 , 0 , $+1$, $+2$, $+3$, $+4$).

Fractions also have opposites. For example, $+\frac{1}{2}$ and $-\frac{1}{2}$ are opposites.

Positive and negative integers and fractions are called rational numbers.

Rational numbers are numbers that can be expressed as one integer divided by another integer.



In mathematical notation, you can write a positive number with a raised plus sign ($+150$) or without any sign (150). You can write a negative number with a raised minus sign (-150). To avoid confusion with operation signs, it is common to use raised signs.

Many calculators have a special negative number key $\boxed{-}$. When you press $5 \boxed{-} \boxed{-} 2$, the calculator shows “ $5 - -2$.”



Getting Ready for Problem 1.1

- Where would the following pairs of numbers be located on the number line?
 - $+7$ and -7
 - $+2.7$ and -2.7
 - -3.8 and $+3.8$
 - $-\frac{1}{2}$ and $+\frac{1}{2}$
 - $4\frac{3}{4}$ and $-4\frac{3}{4}$
- If the same relationship holds true for all numbers, what would be the opposite of $-1\frac{2}{3}$ and where would it be located?

1.1

Playing Math Fever

Ms. Bernoski's math classes often play Math Fever, a game similar to a popular television game show. The game board is shown. Below each category name are five cards. The front of each card shows a point value. The back of each card has a question related to the category. Cards with higher point values have more difficult questions.

Math Fever					
Operations With Fractions	Similarity	Probability	Area and Perimeter	Tiling the Plane	Factors and Multiples
50	50	50	50	50	50
100	100	100	100	100	100
150	150	150	150	150	150
200	200	200	200	200	200
250	250	250	250	250	250

The game is played in teams. One team starts the game by choosing a card. The teacher asks the question on the back of the card. The first team to answer the question correctly gets the point value on the card. The card is then removed from the board. If a team answers the question incorrectly, the point value is subtracted from their score. The team that answers correctly chooses the next category and point value.



Problem 1.1 Using Positive and Negative Numbers

At one point in a game, the scores are as follows:

Super Brains

-300

Rocket Scientists

150

Know-It-Alls

-500

- Which team has the highest score? Which team has the lowest score? Explain.
- What is the difference in points for each pair of teams?
- Use number sentences to describe two possible ways that each team reached its score.
- The current scores are -300 for Super Brains, 150 for Rocket Scientists, and -500 for Know-It-Alls.
 - Write number sentences to represent each sequence of points. Start with the current score for each team.

a. Super Brains

Point Value	Answer
200	Correct
150	Incorrect
50	Correct
50	Correct

b. Rocket Scientists

Point Value	Answer
50	Incorrect
200	Incorrect
100	Correct
150	Incorrect

c. Know-It-Alls

Point Value	Answer
100	Incorrect
200	Correct
150	Incorrect
50	Incorrect

- Now which team has the highest score? Which team has the lowest score?
- What is the difference in points for each pair of teams?
- The number sentences below describe what happens at a particular point during a game of Math Fever. Find each missing number. Explain what each sentence tells about a team's performance and overall score.
 - BrainyActs: $-200 + 150 - 100 = \blacksquare$
 - MathSperts: $450 - 200 = \blacksquare$
 - ExCells: $200 - 250 = \blacksquare$
 - SuperMs: $-350 + \blacksquare = -150$



Homework starts on page 16.